

DRONE



STEAM

DRONES@STEAM

Fostering digital Transformation in VET schools
and creating new job prospects in the labour market

Project Result No: 2

**Activity 3: EDUCATIONAL PACK: TEACHING MATERIAL AND
ASSESSMENT**

UNIT 3, Chapter 3.2

Lead partner(s): Politeknika Txorierrri



Co-funded by
the European Union



This project has been funded with support from the European Commission. This communication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein. Project number: 2021-1-EL01-KA220-VET-000034686

CONTEXT

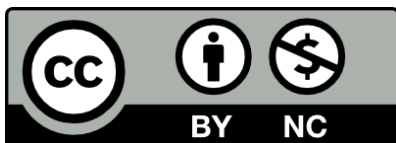
| | |
|-----------------------|---|
| Grant agreement | 2021-1-EL01-KA220-VET-000034686 |
| Programme | Erasmus+ |
| Key action | Cooperation for innovation and the exchange of good practices |
| Action | Strategic Partnerships |
| Project acronym | DRONES@STEAM |
| Project title | DRONES@STEAM: Fostering digital Transformation in VET schools and creating new job prospects in the labour market |
| Project starting date | 28/02/2022 |
| Project duration | 28 months |
| Project end date | 27/06/2024 |

WEBSITE:

<https://dronesteam.eu/>

CONSORTIUM: PARTNER LIST

- University of Crete (UoC) - Greece
- ECAM-EPMI (ECAM) - France
- Cyprus Computer Society (CCS) - Cyprus
- Politeknika Ikastegia Txorierri S. Coop (PIT) – Spain
- National Center for Scientific Research “Demokritos” (NCSR) - Greece
- A & A Emphasys Interactive Solutions Ltd (EMP) – Cyprus
- Regional Directorate of Primary and Secondary Education of Attica (RDPSEA) – Greece



Attribution-NonCommercial
4.0 International ([CC BY-NC 4.0](https://creativecommons.org/licenses/by-nc/4.0/))

Contents

| | |
|--|----|
| UNIT 3: Lesson Plan 3.2 | 4 |
| Activity worksheet 3.2.1 (student version) | 6 |
| Presentation 3.2.1.1: Normative Framework..... | 6 |
| Questionnaire 3.2.1.1: EASA - FAQ..... | 9 |
| Discussion 3.2.1.1: Case Scenarios | 10 |
| Exercise 3.2.1.1: Safe Drone Operation..... | 14 |

UNIT 3: Lesson Plan 3.2

| UNIT 3 | |
|--|--|
| Chapter 3.2 | Safety and Regulations |
| Equipment, Software, Consumables (if needed) | Optional: PC with access to the internet |
| Duration | 2 teaching hours |
| Short description | In this worksheet, students will learn about drone operating conditions in compliance with European drone regulations . They will learn to identify the most common issues and the necessary corrective actions for the drone to operate safely and in accordance with EU regulations |
| Learning Outcomes | Knowledge of drone piloting regulations in the EU, including key concepts such as maximum flight altitudes, drone registration requirements, and no-fly zones |
| | Ability to analyze a given drone flying scenario, to identify key features related to EU regulations, and apply that knowledge to determine the requirements for the pilot, the drone, and its operation, demonstrating an understanding of the regulatory framework for drone operation in the EU |
| | Critical Thinking, Problem-solving, Adaptability |
| Activities | |
| Activity 1 | Presentation 3.2.1.1: Normative Framework |
| Aim of the activity | The aim of the activity is to introduce students to the specific regulations ruling the drone operation in the EU |
| Duration | 15 min |
| Type of Activity | Presentation |
| Teaching Objectives | By the end of this exercise, students will be aware of the current legal and regulatory framework governing drone operations in the EU |
| Resources | Worksheet 3.2.1 / Presentation 3.2.1.1 |
| Activity 2 | |
| Activity 2 | Questionnaire 3.2.1.1: EASA - FAQ |
| Aim of the activity | The aim of the activity is to provide students with a thorough understanding of the regulations and guidelines related to drone piloting. Students will gain knowledge and confidence in their ability to navigate regulations related to drone operation |
| Duration | 30 min |
| Type of Activity | Questionnaire |
| Teaching Objectives | By the end of this exercise, students will be able to identify and interpret key information related to European drone regulations EU 2019/945 and EU 2019/945 |
| Resources | Worksheet 3.2.1 / Questionnaire 3.2.1.1 |
| Activity 3 | |
| Activity 3 | Discussion 3.2.1.1: Case Scenarios |
| Aim of the activity | The activity aims to promote responsible and safe drone operation by increasing students' knowledge and awareness of EU regulations and helping them to understand the importance of complying with these regulations to ensure safety and prevent potential legal issues |
| Duration | 45 min |

| | |
|------------------------|--|
| Type of Activity | Discussion |
| Teaching Objectives | By the end of this exercise, students will be able to identify and apply EU regulations related to drone operation to a given theoretical scenario, including requirements for the pilot, the drone and the operation |
| Resources | Worksheet 3.2.1 / Discussion 3.2.1.1 |
| Activity 4 | |
| Activity 4 | Exercise 3.2.1.1: Safe Drone Operation |
| Aim of the activity | The aim of the activity is to educate students with the necessary knowledge and skills to safely operate drones |
| Duration | 30 min |
| Type of Activity | Exercise |
| Teaching Objectives | By the end of this exercise, students will be able to analyze the advice provided by EASA and their NAA's regarding safe drone flying and use that information to develop their own guidelines for safe drone operation. |
| Resources | Worksheet 3.2.1 / Exercise 3.2.1.1 |
| Further Reading | |
| Resources/Links | <p>Civil drones (unmanned aircraft) EASA (europa.eu)</p> <p>EUR-Lex - 32019R0945 - EN - EUR-Lex (europa.eu)</p> <p>EUR-Lex - 32019R0947 - EN - EUR-Lex (europa.eu)</p> <p>Introduction of a regulatory framework for the operation of unmanned aircraft (europa.eu)</p> <p>https://www.easa.europa.eu/en/domains/civil-drones/drones-regulatory-framework-background/open-category-civil-drones</p> <p>https://www.easa.europa.eu/en/domains/civil-drones-rpas/specific-category-civil-drones</p> <p>https://www.easa.europa.eu/en/domains/civil-drones/drones-regulatory-framework-background/certified-category-civil-drones</p> <p>https://www.easa.europa.eu/en/the-agency/faqs/drones-uas</p> <p>https://www.easa.europa.eu/en/domains/civil-drones/naa</p> |

Activity worksheet 3.2.1 (student version)

Chapter 3.2: Safety and regulations

Level: Intermediate

In this worksheet, we will learn about the specific drone regulations in the EU. More specifically, we will

- Learn which EU drone regulations are in force and their main requirements
- Resolve doubts about legal requirements by consulting official sources
- Analyse theoretical drone operating scenarios to identify compliance or non-compliance with European regulations

Presentation 3.2.1.1: Normative Framework

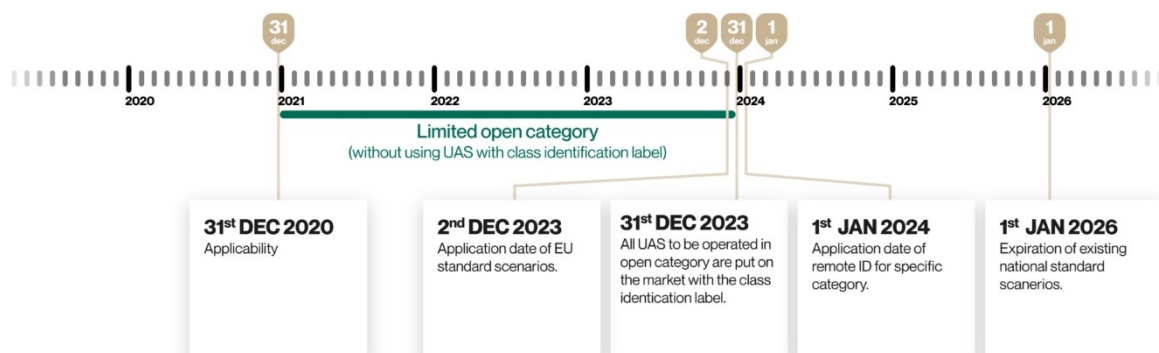
The use of drones in the EU is regulated by the European Union Aviation Safety Agency (EASA) through the EU drone regulations, which are mandatory in their entirety and directly applicable in all 31 European countries.

What is EASA

EASA is the agency responsible for ensuring the highest level of safety and environmental protection in civil aviation in Europe. Its primary function is to develop and implement common safety and environmental standards and regulations, which are then overseen by EU member states. EASA provides technical expertise and support to the EU and its member states in the area of aviation safety, and is responsible for certifying aircraft and components, approving organizations involved in aviation and overseeing the safety management systems of aviation organizations.

Do you know which is the National Aviation Authority (NAA) in your country?

In December 2020, the current regulations concerning UAS and their use entered into application in all member states. European regulations 2019/947 and 2019/945 set out the framework for the safe flight of civil drones in the European skies.



European regulation timeline application

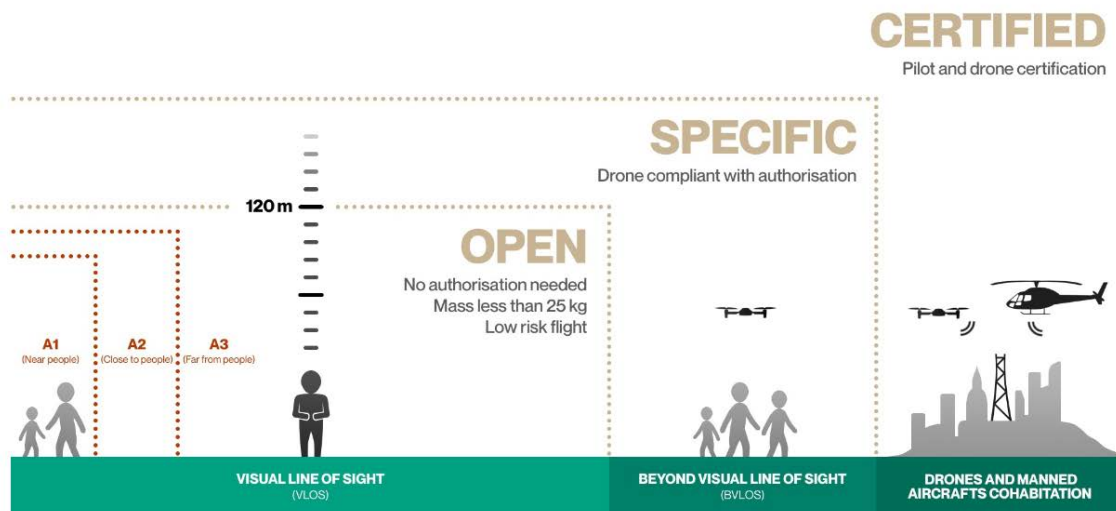
They adopt a risk-based approach, and as such, do not distinguish between leisure or commercial civil drone activities. What they consider is the drone mass, the drone technical specifications and the intended flight. They are two separate regulations within the EU UAS Regulations. While they are related to each other, they serve different purposes.

1. COMMISSION DELEGATED REGULATION (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems (UAS) and on third-country operators of unmanned aircraft systems

- This regulation sets out the rules for the design, manufacture and maintenance of drones. It applies to all UAS intended to be operated in the European Union (EU) regardless of their category of operation. It regulates the requirements for the identification and traceability of drones, as well as their labeling and marking.

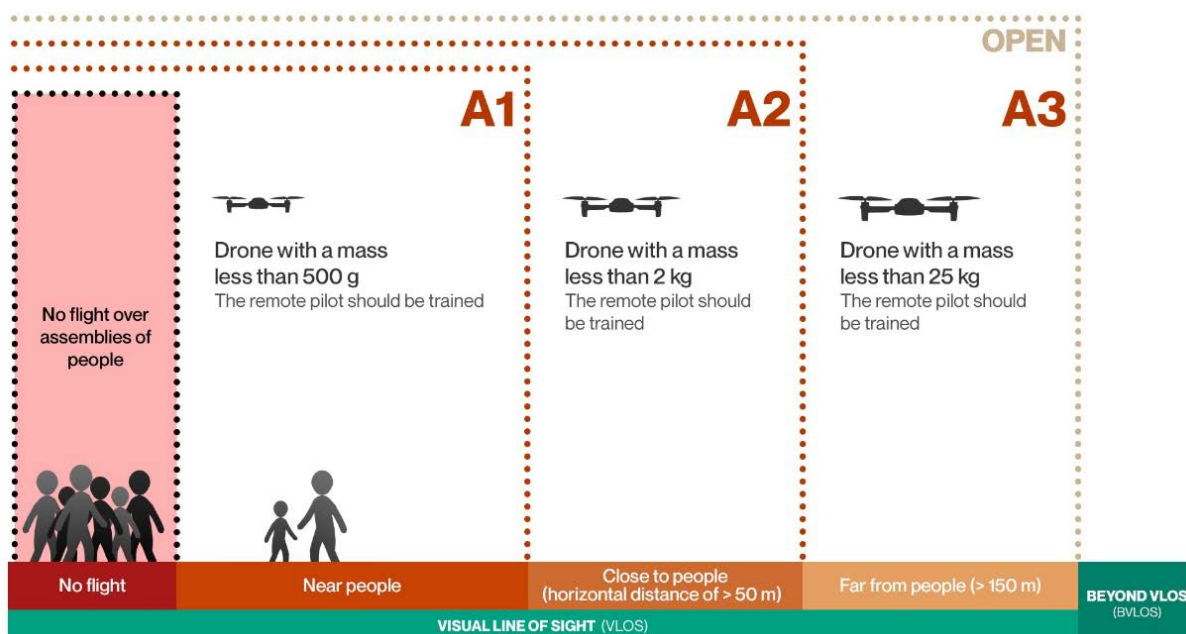
2. COMMISSION IMPLEMENTING REGULATION (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft

- This regulation sets out the operational requirements for the different categories of UAS operations in the EU. It applies to all UAS operations conducted within the EU, regardless of where the drone was manufactured. It defines three categories of UAS operations based on the level of risk they pose to people, property and other aircraft. The regulation establishes requirements for obtaining operational authorizations, the qualifications and training of remote pilots and the use of UAS safety features, such as geo-fencing and electronic visibility.



European Drone Flight categories

As the full application of regulation 2019/947 has been postponed to 1st January 2024, until then, manufacturers and remote pilots can gradually comply with the new EU regulation. During the transition period, a limited open category is implemented.



Limited Open Category

Depending on the characteristics of the drone, the type of operation and the intrinsic risk involved, the Implementing Regulation (EU) 2019/947 establishes the operational restrictions and the requirements for the drone pilot, as illustrated in the chart below.

| UAS / DRONE | | OPERATION | | DRONE OPERATOR / PILOT | | |
|----------------------------------|---------|--|--|--|---|----------|
| Class | MTOM | Subcategory | Operational Restrictions | Drone Operator Registration | Remote Pilot Competence | Min. Age |
| Private construction or No class | < 250 g | A1 (Can also fly in subcategory A3) | <ul style="list-style-type: none"> May fly over uninvolved people (should be avoided when possible) No flight over assemblies of people | No, unless camera (sensor) on board and the drone is not a toy | No training required | - |
| C0 | | | <ul style="list-style-type: none"> No flight expected over uninvolved people (if it happens, overflight should be minimised) No flight over assemblies of people | Yes | | |
| C1 | < 500 g | A2 (Can also fly in subcategory A3) | <ul style="list-style-type: none"> No flight over uninvolved people Keep a horizontal distance of 30 m from uninvolved people (can be reduced to 5 m if the low-speed function is activated) | Yes | <ul style="list-style-type: none"> Read carefully the user manual Obtain a 'Proof of completion for online training' for A1/A3 'open' subcategory by: <ol style="list-style-type: none"> Completing the online training Passing the online theoretical exam | 16* |
| C2 | < 2 kg | | <ul style="list-style-type: none"> Do not fly near people Fly outside urban areas (150 m distance) | Yes | <ul style="list-style-type: none"> Read carefully the user manual Obtain a 'Remote pilot certificate of competency' for A2 'open' subcategory by: <ol style="list-style-type: none"> Having a 'Proof of completion for online training' for A1/A3 'open' subcategory Conducting and declaring a practical self-training Passing an additional theoretical exam at the NAA or proctored online | 16* |
| C3 | < 25 kg | A3 | <ul style="list-style-type: none"> May fly over uninvolved people (should be avoided when possible) No flight over assemblies of people | Yes | <ul style="list-style-type: none"> Read carefully the user manual Obtain a 'Proof of completion for online training' for A1/A3 'open' subcategory by: <ol style="list-style-type: none"> Completing the online training Passing the online theoretical exam | 16* |
| C4 | | | <ul style="list-style-type: none"> Do not fly near people Fly outside urban areas (150 m distance) | | | |
| Private construction or No class | | | <ul style="list-style-type: none"> May fly over uninvolved people (should be avoided when possible) No flight over assemblies of people | | | |

Drone operational category legal requirements

Questionnaire 3.2.1.1: EASA - FAQ

The EASA's drone FAQ website is a valuable resource for students who want to learn about Specific Drone Regulation in the EU, providing clear and concise answers to frequently asked questions and useful information, including: operational categories, drone types, training, authorizations, geographic restrictions, privacy and more.

In this first activity, consult the drone FAQ website and try to get the answers to the questions below.

EASA – DRONES FAQ: <https://www.easa.europa.eu/en/the-agency/faqs/drones-uas>

In case your question has not been solved, you can refer directly to the specific regulation and article to which the help refers, e.g.:

A drone is certified when it has a certificate of airworthiness (or a restricted certificate of airworthiness) issued by the National Aviation Authority. In this case, it requires a registration. A certified drone is needed only when the risk of the operation requires it. So certification is never needed for drones operated in the 'open' category.

Relevant regulation: article 21 of EU regulation 2019/947.

Answer the following questions to gain a better understanding of the regulatory framework for drone operations in the EU:

1. What are the regulations for flying drones in the EU?
2. What is a drone or unmanned aircraft system (UAS)?
3. What is the difference between autonomous and automatic drones?
4. What are the different categories of drone operations?
5. Do I need a license/authorization to operate a drone? How can I get it?
6. What is the maximum altitude that a drone can fly to?
7. Can I fly my drone at night?
8. Is it allowed to fly a drone over people or groups of people?
9. What are the geo-zones and how can they affect drone operations?
10. Can I fly a drone in urban areas?
11. What are the rules for flying a drone near airports?
12. Can I operate a drone in bad weather conditions?
13. What are the weight limits for drones in different categories?
14. Do I need to register my drone?
15. What kind of insurance do I need to operate a drone?
16. Can I carry a payload with my drone?
17. What are the rules for operating a drone for commercial purposes?
18. How can I report a safety incident or violation involving a drone?
19. What are the consequences of flying a drone without following the regulations?
20. What is an NAA and what role does it play in regulating drone operations in the EU?

Discussion 3.2.1.1: Case Scenarios

In this exercise, you will be analysing six (6) theoretical scenarios about the use of drones.

Each group will be assigned a different scenario, and you will have to identify the requirements and compliance with the relevant regulations. It is important that you consult official sources for further verification.

You will discuss about the following features of the scenario:

- Operational category
- Drone Class
- Drone registration
- Required pilot competences
- Operational authorization from the NAA
- Viable according to regulations? Why? Why not?
- Alternative plan

The infographics about the different classes of drones that have been included at the end of the statements may be helpful for you.

SCENARIO 1

“A group of VET students enrolled in a technical school's advanced STEAM program are studying drone piloting. As part of their project, they want to conduct a test flight of a DJI Mavic 2 Pro outside the school campus.

The school is located in a complex airspace with multiple airports, military airbases, and restricted zones. The students must carefully assess the situation and obtain relevant permissions from the local aviation authority, as well as follow strict aviation safety rules and regulations to avoid any potential risks or violations. In addition, they must take into account the environmental impact of their drone flying and the privacy rights of nearby residents.”

SCENARIO 2

“A group of friends belongs to a Trail Running club. Next weekend they have a race and one of them wants to take his Yuneec Q500 4k drone with him, which has Follow Me technology to record himself while he is racing without having to operate the drone.

One of his colleagues doubts that he will be able to do this in a race where so many people come to cheer on the runners.”

SCENARIO 3

“A company specializes in producing long-span steel structures that are utilized in constructing bridges. To ensure the quality of the parts before shipment, one of their employees performs rigorous quality checks. The company has adopted an intelligent metrology system in its factory and utilizes a DJI Matrice 300 RTK drone that comes equipped with a precision camera and a 3D laser scanner. However, due to the massive size of the structures, there are areas where the drone is out of the operator's line of sight.

To overcome the issue of the drone being out of the operator's line of sight, the company has implemented an advanced solution. They have employed a skilled drone pilot who is trained to fly the drone using first-person view (FPV) goggles. With the aid of the goggles, the pilot can see what the drone sees, even if the drone is not within their line of sight.”

SCENARIO 4

“A team of researchers is conducting a study to evaluate the effects of global warming on the Alps. As part of their research, they need to collect samples of ice, soil, and vegetation and take measurements of various gases.

However, access to certain areas in the Alps is too risky, making it difficult to carry out their work, so the researchers use a Parrot Anafi USA drone to assist them in their research. The drone is equipped with specialized sensors that can detect and measure various environmental factors, such as temperature, humidity, and gas levels. With the help of the drone, the researchers can collect data from otherwise inaccessible areas, providing them with valuable information for their study.

The drone's advanced technology allows it to navigate through challenging terrain, such as steep mountain slopes and dense forests, enabling it to reach areas that are difficult for humans to access. The drone can also carry equipment to collect ice and soil samples and collect data on vegetation from above.”

SCENARIO 5

“A wind turbine company is in the process of installing a new wind farm offshore, and they need to inspect the installations to ensure everything is working correctly. However, due to the hazardous conditions on the installation site, it's not safe for humans to perform the inspection. The company decides to use a drone to conduct the necessary checks.

The drone selected is a Skydio X2D, which is designed specifically for industrial applications, including inspections of complex structures in challenging environments. The drone is equipped with a high-resolution camera that can capture detailed images and video of the wind turbines, allowing the company to identify any issues or damage that may have occurred during the installation process.”

SCENARIO 6

“A wildlife conservation organization is working to restore the habitat of an endangered species of bird. They need to drop seed packets over a large area of land, but due to the rough terrain and dense vegetation, it is difficult to access the area on foot. The organization decides to use a 3DR Solo drone to drop the seed packets.





















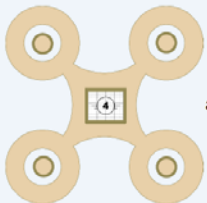



The drone takes off and flies over the designated area, dropping the seed packets at predetermined locations.”

| | | | |
|--------------------|------------------------------------|--|--|
| OPEN CATEGORY – A1 | Private No Class Identification | < 250 g < 19 m/s Self Manufactured | < 250 g No Class Identification In Market before 01/01/2014 |
| | C0 | Maximum Flight Altitude Limited to 120 m < 19 m/s < 250 g Marketed with the instructions of the manufacturer | Controllable and safe to operate Designed to avoid harming people Electric |
| | C1 | Maximum Flight Altitude Limited to 120 m < 900 g or Impact energy < 80J < 19 m/s Marketed with the instructions of the manufacturer Geo-science System | Controllable and safe to operate Designed to avoid harming people Method to end the flight safely or recover the recover the connection in case of loss Remote Identification Electric Physical and unique serial no. ABC - 123 Equipped with controllability lights visible at night |

Open Category – Subcategory A1 Operating Drones

| | | | |
|--------------------|----|---|--|
| OPEN CATEGORY – A2 | C2 | Maximum Flight Altitude Limited to 120 m Low speed function id (limit v < 3 m/s) Marketed with the instructions of the manufacturer < 4 kg Electric Geo-science System | Controllable and safe to operate Data link protected against interference Designed to avoid harming people Method to end the flight safely or recover the recover the connection in case of loss Remote Identification Equipped with controllability lights visible at night Physical and unique serial no. ABC - 123 |
|--------------------|----|---|--|

Open Category – Subcategory A2 Operating Drones

| | |
|--------------------|---|
| OPEN CATEGORY – A3 | <p>Private No Class Identification</p>  <ul style="list-style-type: none">  < 250 g  < 19 m/s  Self Manufactured  <ul style="list-style-type: none">  < 250 g  No Class Identification  In Market before 01/01/204 |
| | <p>C3</p>  <p>Controllable and safe to operate</p> <ul style="list-style-type: none">  Maximum Flight Altitude Limited to 120 m  Maximum dimension < 3 m  Marketed with the instructions of the manufacturer  < 25 kg  Electric  Geoconscience System  Data link protected against interference  Method to end the flight safely or recover the connection in case of loss  Remote Identification  Equipped with controllability lights visible at night  Physical and unique serial no. ABC-123 |
| | <p>C4</p>  <p>Controllable and safe to operate</p> <ul style="list-style-type: none">  Marketed with the instructions of the manufacturer  < 25 kg  No automatic flight mode automatic flight mode, except for stabilization assistance and in case of loss of connection |

Open Category – Subcategory A3 Operating Drones

Exercise 3.2.1.1: Safe Drone Operation

In this exercise, we will work together as a class to research and review the EASA and our country's NAA guidelines for safe drone operation.



Our task is to create a guideline that covers general safe drone operation practices, such as pre-flight checks, proper flight planning, and emergency procedures. You will base your guidelines on what you have learned from the authorities, but you can also include additional items that you consider important for ensuring safe drone operation and accident prevention.